THE CONTINUING DISPERSION OF *PERISTENUS DIGONEUTIS* LOAN (HYMENOPTERA: BRACONIDAE), AN INTRODUCED PARASITE OF THE TARNISHED PLANT BUG, *LYGUS LINEOLARIS* (PALISOT) (HEMIPTERA: MIRIDAE) IN NORTHEASTERN U.S.A. AND SOUTHEASTERN CANADA[1]

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ABSTRACT: *Peristenus digoneutis* Loan, a European species, was first established by USDA-ARS in New Jersey for the biological control of the tarnished plant bug, which damages many crops. This parasitic wasp has steadily dispersed since its establishment in 1984, and it is now present in 11 states, a 38% increase since our last report in 2003, and has been found in 69 counties in the United States. *Peristenus digoneutis* is now present in all of the northeastern states, is moving westward along the southern edge of Lake Erie, and is well established in at least three Canadian provinces.

The tarnished plant bug, *Lygus lineolaris* (Palisot) is an important insect pest of many crops in North America (Day et al., 2003, Liu et al., 2003). Its wide host range, economic importance, and lack of effective natural enemies made it a candidate for classical biological control (Day et al., 1990); and European parasites were ultimately released in the U.S.A.

Once an exotic natural enemy of this pest had been established, it was desirable to conduct field surveys to determine its range expansion over a number of years. Such geographic distribution data are necessary to estimate dispersion rates, to determine where the climatic limits of the beneficial species have been reached, and to learn where the introduced species is abundant, so effectiveness studies can be initiated (Day et al., 1998).

In previous reports (Day et al., 1990, 1998, 2000, 2003) we documented the initial establishment of *Peristenus digoneutis* Loan by the USDA in northwestern New Jersey, its subsequent dispersion into 62 counties and eight states, and its reduction of tarnished plant bug [*Lygus lineolaris* (Palisot)] populations in the northeastern U.S. (Day 1996, Day et al., 2003). In this paper, we report additional range expansions of this parasite into three additional states, for a total of eleven states, and list five new county records.

METHODS

Sweep net samples were taken in alfalfa and weedy fields, and the tarnished plant bug nymphs obtained were reared in the laboratory, to produce the adult

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parasites required for identification. Rearing and collection methods are in Day et al. (2000). Adult parasites were identified to species by the first author using characters that are now in the comprehensive keys by Goulet and Mason (2006). Voucher specimens are in the USDA collection at Newark, Delaware, and in the Canadian National collection at Ottawa, Ontario, Canada. Because unmated female *P. digoneutis* produce only male progeny, but mated females produce both sexes, collection sites that produced only male parasites have not been regarded as proof that a mating population was present, so these locations are listed separately from positive establishment locations.

Fig. 1. The known and estimated distribution of *Peristenus digoneutis* (dashed line) in eastern North America in 2005. The asterisk indicates its initial establishment point. Abbreviations, as follows: In Canada, Que. = Quebec, N.B. = New Brunswick, P.E.I. = Prince Edward Island, N.S. = Nova Scotia, and Newf. – Newfoundland. In the U.S.A. ME = Maine, NH = New Hampshire, VT = Vermont, MA = Massachusetts, RI = Rhode Island, CT = Connecticut, NY = New York, PA= Pennsylvania, NJ = New Jersey, DE = Delaware, MD = Maryland, VA = Virginia, WV = West Virginia, KY = Kentucky, OH = Ohio, and MI = Michigan.

RESULTS AND DISCUSSION

Table 1 provides three new state establishment records and five new county records for *P. digoneutis*. These bring the total known range of this species to 11 states and 69 counties in the northeastern United States. In addition, the presence of *P. digoneutis* in northeastern Ohio indicates that this species is dispersing

westward around the Great Lakes, as predicted for "cool summer" locations in both the northeastern United States and adjacent Canada (Day et al., 2000).

Peristenus digoneutis is also clearly established in adjacent Canada; females were recovered in Quebec in 1999 (at St. Clothilde), in Ontario in 2002 (at Mountain), and females were collected in Nova Scotia in 2006 (near Kentville, H. Goulet, personal communication). This species has also recently been established in California (Pickett et al., 2007). The approximate distribution of *P. digoneutis* in eastern North America is shown in Fig. 1.

Table 1. New county and state detection records for *P. digoneutis*, 2003-2005. New records are represented in **bold type**, and are based on female parasites reared from *Lygus* nymphs. Numbers to the left of the state represent chronological state ranking in the dispersion of *P. digoneutis* in the U.S.A. For example, Rhode Island is the ninth state in the U.S.A. where *P. digoneutis* has been reported.

	State	County	Year	Collector
9.	**Rhode Island**	**Washington**	2003	Faubert
	Pennsylvania	**Lehigh**	2003	Romig
		Schuykill	2004	Romig
10.	**Ohio**	**Portage**	2004	Romig
11.	**Delaware**	**New Castle**	2005[a]	Tatman

[a] A few *P. digoneutis* were reared from nymphs collected in both 2005 and 2006 in Delaware. If this population persists [it had been collected here in 1992 and 1993, but not in 1994-1995 (Day et al., 1998)], this will be the most southern establishment location for this species.

Possible additional records are in Table 2. These are tentative because although no females were reared from these counties, parasitism rates in dissected subsamples were much higher (20-32%) than is typical for native parasite species (13-18%: Day, 1996) suggesting that *P. digoneutis* is likely established. In addition, because our surveys were terminated in 2004, it is probable that the range of this parasite is now considerably larger than the 69 counties noted above.

Table 2. Probable[a] new distribution locations for *P. digoneutis*: 2004 collections.

State	County	% Parasitism	Notes
New York	Erie	30%	
Ohio	Geauga	32%	a male was also reared[c]
Pennsylvania	Berks	20%	a male was also reared[c]
	Erie, field #8	22%	
	Erie, field #9	20%	
	Warren	23%	

[a] "Probable" because these records are based on parasite larvae detected in dissections of Lygus nymphs (the sex of parasite larvae cannot be visually determined).

[b] Rates higher than the average maximum (13%: Day et al., 1990) by the native *Peristenus pallipes* (Curtis) in dissected *L. lineolaris* nymphs are probable evidence that the introduced *P. digoneutis* is present in a sample.

[c] However, only females are proof of a reproducing population (Day et al., 1990).

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